

Navy Simulation Meets the Challenge

By the Navy Warfare Development Command

The crew of the Aegis destroyer knows there is an enemy submarine nearby because the strike group has been tracking it for days, but water conditions have deteriorated, and the boat's electric drive simply isn't generating enough noise. The sea state is such that a periscope will be difficult to detect among the sea clutter. An EP-3 is flying over the area alert for intercepts on the sub's electronic signature, but the crew has been in the air for hours, and the aircraft's fuel state is reaching a critical point where the plane will have to turn for home soon.

The tension in the Combat Information Center is palpable. The stakes couldn't be higher: the safety of more than 20 ships, including two aircraft carriers and almost 15,000 men and women, is on the line.

Suddenly, a report of a faint sonobouy return gives the crew the first hint on the sub's location in more than three hours. Despite the heavy swells coming from the southwest, the ship turns to reposition the search. The crew have the know-how and skills to end the hunt and ensure the safety of the battleforce. They have the will and the equipment to make it work ...

And none of this is real.

Planners at the U.S. Pacific and U.S. Joint Forces (JFCOM) commands want to ensure that operational staffs are trained in the most realistic operational environment that can be produced — short of actually deploying vast numbers of troops, ships and aircraft to the field. To accomplish this, they called upon the expertise of the modeling and simulation (M&S) community to make the command post exercise Terminal Fury 07 (TF-07) as demanding and faithful to reality as possible.

One of the commands instrumental in developing simulation fidelity is the Navy Warfare Development Command in Newport, R.I. When it was founded in 1998, NWDC had a problem: One of its missions was to conduct complex experiments to evaluate and further develop new concepts and doctrine. The resources needed for these experiments were significant and not always available. In addition, they often involved technologies that did not yet exist.

The clear answer was to use modeling and simulation aggressively, but the fidelity of existing simulation was minimal. The ability to factor in crucial data elements was fractional compared with the requirements, and it was often not possible to determine the outcome of a decision or series of events due to the limited capabilities simulation had to offer.

So the NWDC engineering team began a systematic approach for improving modeling and simulation to produce accurate and reliable results. As the degree of experimentation became more and more complex, the M&S capability to faithfully replicate environmental and operational conditions became equally complex. By the time Fleet Battle Experiment Echo (FBE-E) occurred in 1999, simulations representing forces in the experiment could be networked and federated into a single synthetic warfighting environment through the Joint Semi-Automated Forces (JSAF) simulation system supported by the NWDC.

By the time the command supported FBE-Juliet, part of JFCOM's Millennium Challenge 2002, the fleet saw a nearly seamless blend of a simulated environment that could be combined with live, virtual and constructive forces. It was an impressive display of the potential of M&S to replace scarce real-world assets and costly operational time.

Up until 2003, when the NWDC provided modeling and stimulation to fleet assets, truckloads of equipment and busloads of people had to be transported to a site near the action, and a lab had to be created on-site to operate the modeling and simulation. The preparations for FBE Kilo that year included the development of an

M&S lab at NWDC headquarters and a sophisticated networking approach to distributing simulation worldwide. For the first time, NWDC could provide systems-level stimulation to ships at sea anywhere in the world from its home base in Rhode Island.

But the simulations used for fleet training did not compare well with what commands were seeing during the FBEs. At the request of the fleet, NWDC was tasked to investigate the possibility of applying its modeling and simulation expertise to fleet training. The results were dramatic. The NWDC team applied its technology and skill set to creating a vastly enhanced fleet synthetic training environment. This capability was applied to the existing Battle Force Tactical Training program and then expanded to support Battle Group Inport Exercises.

In short order, this was further expanded to support Multiple Battle Group Inport Exercises (MBGIE) which could simultaneously simulate onboard systems on ships assigned to several different strike groups. Ships pier-side, in such disparate locations as San Diego, Norfolk, Mayport and Bremerton, could interoperate as if they were at sea together. The effort has advanced synthetic training to the point where the NWDC provides executive management of the Navy Continuous Training Environment.

The most recent application of this technology was during PACOM's 10-day TF-07 series, which demonstrated that this architecture supports simulated training events at every echelon of the Navy and joint command structure — from console operator — to combatant command staff and commander.



Terminal Fury 07 surface simulation sub-area.

The exercise linked staffs at PACOM headquarters, Camp Smith, Hawaii; Joint Task Force 519, Makalapa Compound, Pearl Harbor, Hawaii; Kenney Headquarters, Hickam Air Force Base, Hawaii; III Marine Expeditionary Force, Camp Courtney, Okinawa, Japan; U.S. Seventh Fleet aboard USS Blue Ridge (LCC 19); 1st Corps Headquarters, Fort Lewis, Wash.; 4th Psychological Operations Group, Fort Bragg, N.C.; U.S. Strategic Command, Offutt Air Force Base, Neb.; Commander Task Force (CTF) 70 aboard USS Kitty Hawk (CV 63); CTF 72, Misawa, Japan; and CTF 74, Yokosuka, Japan.

More than 150 people participated in the 24-hour simulations originating from Newport, which provided enhanced training for the Pacific Command and Joint Task Force 519 staffs in all aspects of crisis planning and procedures in PACOM's area of operations.

Through a federation of M&S organizations across the services, the NWDC provided the maritime elements of the simulated environment and controlled both virtual and constructive forces play during the exercise. In addition, the NWDC provided exercise control and network and technical support.

The federation of modeling and simulation capabilities permitted the integration of the individual service and joint simulation systems during the exercise. NWDC and JFCOM participated through the Joint Semi-Automated Forces simulation. Land forces were simulated in the Joint Conflict and Tactical Simulation, and the Air Force participated through the Air Warfare Simulation.

One of the remarkable features of the federated network is the ability to incorporate individual units and trainers into the simulation. During Terminal Fury, an EP3 Mission Avionics System Trainer and an E2C Weapons Systems Trainer "flew" during simulated operations. Their respective performances fully blended into the constructive operational units generated by the JSAF environment. In addition, the 7th Fleet staff participated in the live command post exercise from its command center aboard the USS Blue Ridge pier-side in Yokosuka.

The simulation provided the JTF commander, acting as the Joint Forces Maritime Component Commander, a fully reactive simulation down to the individual tactical platform with sensors interacting in a high fidelity environment, and platforms with realistic tactical loads and operational capabilities. Command and control decisions could be fully developed and analyzed as the employment of the JTF progressed. It was a level of realism that, in the past, could only be achieved through the use of live forces.

In addition to tactical displays that faithfully reproduced the geospatial distribution of the participating forces, realism was further enhanced through the use of unit tactical radio circuitry for communications through voice-over-IP technology. This integrated tactical radio line-of-sight equipment with the Internet so that warfighters could use the same communications gear that they would use in actual operations allowing worldwide transport of the communications between geographically dispersed participants.

The lab at NWDC was a beehive of activity throughout the exercise. Cells provided an exercise control group for the strike group and tactical aviation; blue submarine, carrier and air patrol operations; and technical support. In a separate area, an Intel Cell provided intelligence for both the control and operations teams. In a third area, the Red Cell team mimicked opposition forces and provided specialized support, such as the Theater Battle Management Core Systems (TBMCS) and Global Command and Control System – Maritime.



Members of the Terminal Fury 07 Joint Exercise Control Group, left to right, Cmdr. Charles Strassle, 7th Fleet operational support officer and naval force lead; Capt. Chris Gallagher, Joint Forces Warfighting Center liaison officer to the Maritime Cell; and Lt. Cmdr. Brian Bronk, PACOM liaison officer to the Maritime Cell. U.S. Navy photos by John Woodhouse.

TF-07 marked the first time that the NWDC engineering team introduced the use of a completely reworked interface to TBMCS. This system provides a dynamic method for the air component commander to update air tasking. By using a new JSAF/TBMCS interface, the lab provided an automated process to integrate air operations into the simulation.

Training support for an exercise this large and complex took months of preparation. The December command post event was preceded by more than six months of detailed work that included two weeks of systems testing in August, three weeks of testing in October and a week of integrated operations testing and training immediately prior to exercise commencement to ensure that the Navy Continuous Training Environment backbone and the Joint Training and Experimentation Network could support the demands of the exercise.

Future preparations will be significantly reduced because the interfaces between the services' simulation systems are standardized.

The application of modeling and simulation technologies to earlier war games provided the foundation that drove the evolution to better and more capable technologies to support the demands of Navy experimentation. The Navy soon discovered that this same technology could significantly enhance fleet training at every level of the warfare continuum, so it was a natural development to apply this same level of fidelity to naval and joint exercises.

The Navy Warfare Development Command is tasked with ever more complex support requirements for better experimentation and more realistic training in the modeling and simulation environment.



For more information visit the Navy Warfare Development Command at <http://www.nwdc.navy.mil>.

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